

525 A2
We claim:

1 1. A method for patterning a multilayered conductor/substrate structure
2 comprising the steps of:

3 providing a multilayered conductor/substrate structure which includes a plastic
4 substrate and at least one conductive layer overlying the plastic substrate; and

5 irradiating the multilayered conductor/substrate structure with ultraviolet
6 radiation such that portions of the at least one conductive layer are ablated therefrom.

1 2. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the ultraviolet radiation is spatially incoherent.

1 3. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the ultraviolet radiation has a wavelength in the mid-UV range.

1 4. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the irradiating step comprises employing an excimer laser to ablate
3 portions of the at least one conductive layer.

1 5. The method for patterning a multilayered conductor/substrate structure
2 of claim 4 wherein the step of employing the excimer laser comprises controlling the
3 excimer laser in consideration of how well the at least one conductive layer absorbs
4 radiation at particular wavelengths.

1 6. The method for patterning a multilayered conductor/substrate structure
2 of claim 4 wherein the step of employing the excimer laser comprises controlling the
3 excimer laser to image a pattern from a mask onto the at least one conductive layer.

1 7. The method for patterning a multilayered conductor/substrate structure
2 of claim 6 wherein the pattern includes a line gap which is at least as small as 10 μm .

1 8. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the multilayered conductor/substrate structure further comprises at

3 least one functional layer intermediate the at least one conductive layer and the plastic
4 substrate, the at least one functional layer comprising an insulating material.

1 9. The method for patterning a multilayered conductor/substrate structure
2 of claim 8 wherein the irradiating step comprises employing and controlling an excimer
3 laser to irradiate a portion of the at least one conductive layer such that a portion of the
4 at least one functional layer therebeneath heats and swells a desired amount.

1 10. The method for patterning a multilayered conductor/substrate structure
2 of claim 9 wherein the step of controlling the excimer laser comprises controlling a
3 fluence of the excimer laser in consideration of an ablation threshold level of the at least
4 one conductive layer.

1 11. The method for patterning a multilayered conductor/substrate structure
2 of claim 8 wherein the irradiating step comprises employing and controlling an excimer
3 laser to ablate portions of the at least one conductive layer without completely
4 decomposing the at least one functional layer therebeneath.

1 12. The method for patterning a multilayered conductor/substrate structure
2 of claim 4 wherein the excimer laser is part of a projection-type ablation system.

1 13. The method for patterning a multilayered conductor/substrate structure
2 of claim 12 wherein the projection-type ablation system is configured to project a
3 broadened laser beam.

1 14. The method for patterning a multilayered conductor/substrate structure
2 of claim 13 wherein the projection-type ablation system is configured to project the
3 broadened laser beam onto a patterned mask positioned over but not touching the at least
4 one conductive layer.

1 15. The method for patterning a multilayered conductor/substrate structure
2 of claim 14 wherein the broadened laser beam irradiates at least a 50 mm²-sized portion
3 of the patterned mask.

1 16. The method for patterning a multilayered conductor/substrate structure
2 of claim 4 wherein the excimer laser is configured to emit light at a discrete
3 characteristic wavelength.

1 17. The method for patterning a multilayered conductor/substrate structure
2 of claim 16 wherein the characteristic wavelength is 308 nm.

1 18. The method for patterning a multilayered conductor/substrate structure
2 of claim 16 wherein the characteristic wavelength is 248 nm.

1 19. The method for patterning a multilayered conductor/substrate structure
2 of claim 4 wherein the excimer laser is part of an ablation system configured to facilitate
3 a roll-to-roll production process.

1 20. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the plastic substrate comprises polyethylene terephthalate (PET) ,
3 polyethylenenaphthalate (PEN), polyethersulphone (PES) or polycarbonate (PC).

1 21. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the plastic substrate comprises a polyolefin material.

1 22. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises an oxide layer.

1 23. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises an indium tin oxide
3 (ITO) layer.

1 24. The method for patterning a multilayered conductor/substrate structure
2 of claim 23 wherein the ITO layer is polycrystalline.

1 25. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises an alloy.

1 26. The method for patterning a multilayered conductor/substrate structure
2 of claim 25 wherein the alloy is an indium tin oxide (ITO) alloy.

1 27. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises a metal-based layer.

1 28. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises a silver-based layer.

1 29. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer comprises silver and gold.

1 30. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer is a multilayered conductive film.

1 31. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer, where it has not been etched, has a
3 thickness between around 10 nm and around 120 nm.

1 32. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer has a resistivity of no greater than
3 80 Ω /square.

1 33. The method for patterning a multilayered conductor/substrate structure
2 of claim 1 wherein the at least one conductive layer has a transmissivity of at least 80%.

1 34. The method for patterning a multilayered conductor/substrate structure
2 of claim 8 wherein the at least one functional layer comprises a protective layer which
3 serves to protect layers beneath the protective layer from laser irradiation.

1 35. The method for patterning a multilayered conductor/substrate structure
2 of claim 34 wherein the layers beneath comprise a barrier layer which serves to protect
3 the plastic substrate from environmental damage.

1 36. The method for patterning a multilayered conductor/substrate structure
2 of claim 34 wherein the layers beneath include the plastic substrate.

1 37. The method for patterning a multilayered conductor/substrate structure
2 of claim 8 wherein the at least one functional layer comprises a layer of acrylic which
3 abuts the at least one conductive layer.

1 38. The method for patterning a multilayered conductor/substrate structure
2 of claim 8 wherein the at least one functional layer comprises a barrier layer which
3 serves to protect the plastic substrate from environmental damage.

1 39. The method for patterning a multilayered conductor/substrate structure
2 of claim 38 wherein the barrier layer is inorganic.

1 40. The method for patterning a multilayered conductor/substrate structure
2 of claim 38 wherein the barrier layer has an oxygen transmission rate (OTR) no greater
3 than 0.05 cc/m²/day.

1 41. The method for patterning a multilayered conductor/substrate structure
2 of claim 38 wherein the barrier layer has a water vapor transmission rate (WVTR) no
3 greater than 0.05 g/m²/day.

1 42. The method for patterning a multilayered conductor/substrate structure
2 of claim 38 wherein the barrier layer comprises a layer of SiO_x which abuts the plastic
3 substrate.

1 43. The method for patterning a multilayered conductor/substrate structure
2 of claim 8, further comprising:

- 3 an additional functional layer abutting a side of the plastic substrate that faces
- 4 away from the at least one conductive layer, the additional functional layer serving to
- 5 provide structural protection and/or environmental protection for the plastic substrate.